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(71)(72) Applicant and Inventor: GARDENER, Anthony, John [AU/AU]; 5th floor, Suite 501, 400 Hunter Street, Newcastle, NSW 2300 (AU).

(74) Agent: CARTER SMITH & BEADLE; P.O. Box N301, Grosvenor Place, Sydney, NSW 1220 (AU).

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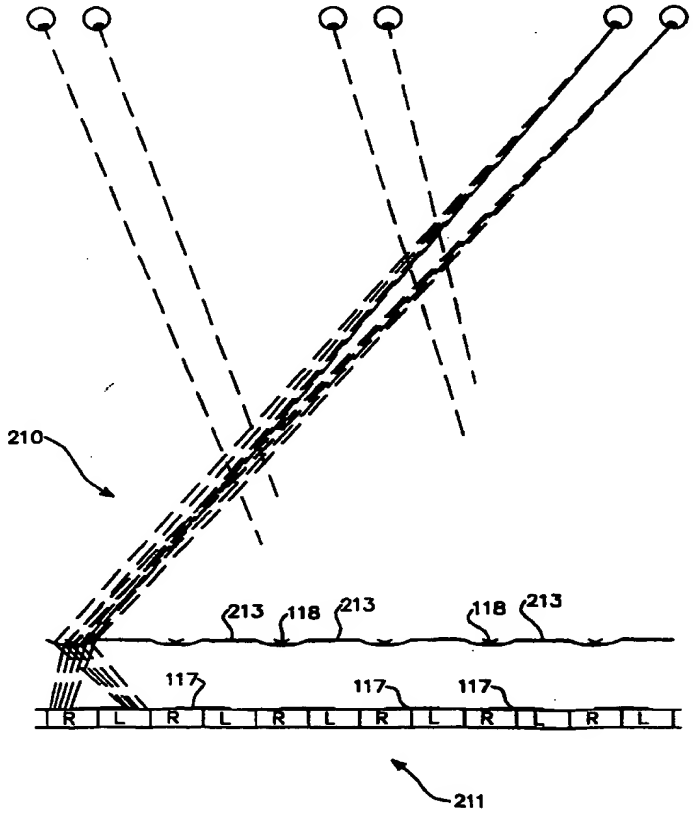
(54) Title: STEREOSCOPIC VIEWING SYSTEM

(57) Abstract

A stereoscopic viewing system (10, 110, 210) comprising a raw image (11, 111, 211) having overlaid thereover a distance D therefrom a mask (12, 112, 212) the mask including opaque strips, (17, 117, 217) therein arranged so as to overlay portions of respective right and left image strips (13, 14, 113, 114). In a particular version opaque strips are included as part of the raw image (11, 111, 211) and also as part of the mask (112, 212) or both.



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STEREOSCOPIC VIEWING SYSTEM

The present invention relates to a stereoscopic viewing system and, more particularly, to such a system adapted for viewing a stereoscopic image without the aid of spectacles or similar image separating device located close to the eyes of a viewer.

BACKGROUND

Forms of stereoscopic television/video systems which provide stereoscopic viewing without the use of glasses or other encumbrances placed close to the eyes of a viewer are known. Once such system is the so-called lenticular system wherein the image for viewing is made up of interleaved vertical image strips from two (left image and right image) camera views. In order to allow the eyes to resolve the two images into a single stereoscopic image, lenses in the form of vertically arranged contiguous cylindric lenses overlay the vertical image strips whereby, by refraction, the left image is directed towards the left eye of a viewer and the right image is directed towards the right eye of a viewer when the eyes are placed in a predetermined focal plane, or very near thereto. U.S. Patent No. 5,258,833 to Schenk describes this general background with reference to U.S. Patent No. 4,214,257 (Yamauchi) and U.S. Patent No. 2,543,793 (Marks). The systems described in those patents suffer from a sensitivity in the location of the focal plane for viewing and suffer from a large amount of light scatter.

It is an object of the present invention to ameliorate the above-mentioned problem and/or at least provide a useful alternative.

BRIEF DESCRIPTION OF INVENTION

Accordingly, in one broad form of the invention, there is provided a stereoscopic viewing system comprising a raw image overlaid by a mask arranged so that a viewer can resolve a stereoscopic image derived from said raw image in

a focal plane of predetermined width located a predetermined distance from said mask.

Preferably said raw image is comprised of alternating left image strips and right image strips on both of pitch P.

Preferably said mask includes vertical lenticular lens strips corresponding to said left and right image strips and arranged to refract light received therefrom so as to cause a stereoscopic image to be resolved by said viewer in said focal plane.

Preferably said mask further includes opaque vertical strips interposed in between said lenticular lens strips.

Preferably said opaque strips are of pitch P and overlay half the width of adjacent left and right image strips.

Preferably said raw image includes raw image opaque strips interposed between said alternating left image strips and right image strips.

Preferably said lenticular lens strips are in the form of tri-elliptical lenses.

In an alternative preferred form said lenticular lens strips are in the form of a circular cross-section lens.

Preferably said circular cross-section lens is formed as a series of adjacent, planar approximations.

Preferably said mask is formed as a base elongate portion of optical material into a first surface of which are formed lens elements.

Preferably said base elongate portion includes opaque strips placed on said first surface between said lens elements.

BRIEF DESCRIPTION OF DRAWINGS

Embodiments of the invention will now be described with reference to the accompanying drawings wherein:-

Figure 1 illustrates the general layout of a stereoscopic viewing system to which embodiments of the present invention can be applied;

Figure 2 illustrates steps in the formation of a raw stereoscopic image to which a first embodiment of the invention can be applied;

Figure 3 illustrates a mask applicable to the raw image of Figure 2 according to a first embodiment of the invention;

Figure 4 illustrates a mask applicable to a flat panel or plasma display;

Figure 5 illustrates a specific driver circuit for the production of an active raw image;

Figure 6 illustrates an arrangement of raw image and mask according to a further embodiment of the invention;

Figure 7 illustrates a raw image and mask layout according to a further embodiment of the invention;

Figure 8 is a detailed view in cross section of the mask of Figure 7; and

Figure 9 is a detailed view in side section of a mask according to a further embodiment of the invention.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

With reference to Figure 1, there is shown a stereoscopic viewing system 10 comprising a raw image 11 and a mask 12. The mask 12 includes an optical arrangement whereby light rays from the raw image 11 are directed to either the left eye 13 or right eye 14 of a viewer 15 so as to form a three-dimensional image to the viewer.

With reference to Figures 2A and 2B, the raw image 11 is formed as follows:-

A stereoscopic image is generated initially as two separate images comprising a left eye view and a right eye view. The left eye view is labelled image A whilst the right eye view is labelled image B. Each image is then divided up into vertical strips of pitch P. Figure 2A represents the left image thus partitioned. Figure 2B represents the right eye image thus partitioned. Consecutive strips are then interchanged between the two images as indicated by the arrows thereby to produce a raw image 11 which combines both the left and right images in it in alternating strips as shown.

The raw image may be in the form of a photograph or like 'passive'/reflective image source or it may be in the form of a video display or like 'active'/light emitting image source. In either case, light reflected from or light emanating from the raw image needs to be optically processed through a mask 12 so as to redirect the light rays for reconstruction by eyes 13, 14.

EP744872 discloses a particular implementation of this kind of stereoscopic image system wherein the mask 12 (termed barrier 2 in EP744872) is an electronically controlled shutter mechanism which can dynamically switch and direct the respective right and left images to the respective right and left observer eyes.

As previously discussed the light refracting element of a "lenticular" system more often includes a lens such as lens element 48 shown, for example, in Figure 31A of EP744872.

The particular implementation illustrated in Figs. 2A and 2B shows strip widths for the alternating left eye images A and right eye images B of width or pitch P. A good summary of the history and implementation of this kind of system is to be found in IEEE publication "Present Status of Three-Dimensional Television Research" in Proceedings of IEEE volume 83, No 7 July 1995.

With reference to Figure 3 an implementation of the mask 12 according to a first embodiment of the invention is illustrated. Specifically Figure 3A shows the raw image 11 to which the mask 12 of Figure 3B is applied or overlaid, and including opaque strips 17 as illustrated. The displacement or distance D between the raw image 11 and the mask 12 can, according to the implementation, vary between 0 and typically around 2-13cms depending on the nature of the light refracting element used to form the lens strips 16.

The raw image 11 of Figure 3A comprising alternating vertical strips of left image A and right image B is overlaid by the mask generally illustrated in Figure 3B. The mask comprises vertical lens strips 16 of pitch P arranged to overlay a half-width of a left image strip and a half-width of a right image strip. The lens strips 16 are of the lenticular type and can be constructed in the manner described in U.S. Patent No. 5,258,833.

Interposed between the lens strips 16 are opaque strips 17, also of pitch P and also arranged so as to overlay a half-width of adjacent left image strips and right image strips A, B as generally illustrated in Figure 3B.

With reference to Figure 4, the manner of construction of a colour raw image 18 is illustrated in Figure 4A and comprises alternating left image colour strips 19 and right image colour strips 20. Each image strip is, itself, comprised of three primary colour strips labelled R (red) G (green) and B (blue). The corresponding colour mask 21 is illustrated in Figure 4B and comprises left vertical lens strips 22 and alternating right vertical lens strips 23, each constructed according to the lenticular methods previously known. In addition, an opaque strip 24 is placed, as illustrated in Figure 4B immediately between adjacent vertical lens strips 22, 23 and, correspondingly, 23, 22. The pitch of the opaque strip 24 is such as to cover a primary colour strip, a different colour strip in each consecutive occurrence.

In this manner, it will be noted that the opaque strips remove some redundant image information according to a predetermined algorithm. The effect, it is postulated, is to widen the width W of the focal plane 25 of viewer 15 in which a stereoscopic image can be resolved.

Figure 5 illustrates a driver arrangement suitable for use with the embodiments of the invention where an active display (such as a CRT, LEDs or back lit matrix) wherein a parallax image source 26 resolves a stereoscopic image comprising a left eye image A and a right eye image B into an A data stream 27 and a B data stream 28 which are fed to screen driver 29 which resolves the data streams 27, 28 into respective vertical strip data streams 30, 31 which are directed to the respective vertical strips comprising raw image 11.

Figure 6 illustrates in plan view a further embodiment of the invention comprising raw image 111 made up of respective left image strips 113 and right image strips 114, all of equal width or pitch P and having opaque strips 117 or width or pitch P laid thereover on the viewing side as illustrated in Figure 6. Specifically the opaque strips 117 are of width or pitch P and are arranged so that each overlies half of the area of adjoining left and right image strips 113, 114.

In addition the stereoscopic viewing system 110 includes mask 112 comprised of a linear array of tri-elliptical lenses 118. Each tri-elliptical 118 is itself formed from three intersecting strip lenses of ellipsoid cross-section as perhaps best seen in detail in Figure 8. The function of each of these lenses 118 is as typically found in "lenticular" stereoscopic systems, being to refract the light received from collective left image strips 113 to a left eye 115 of a viewer and to also refract (bend) the light received from collective right image strips 114 to the right eye 116 of a viewer when located in a specified focal plane 119.

In this embodiment the lenses 118 are contiguously connected in a linear array as illustrated in Figure 6. The only masking of light information is performed by opaque strips 117 located, in this instance, directly on the raw image 111 as illustrated.

Figure 7 illustrates a further embodiment of the invention comprising a stereoscopic viewing system 210 having a raw image 211 and a mask 212 but wherein all other components are numbered as for the embodiment of Figure 6 where like components are utilised.

In this embodiment opaque mask elements are placed between each tri-elliptical lens 118 in the manner illustrated in Figure 7. The opaque strips 117 are also utilised applied directly to the raw image 211.

In this instance the width of the opaque mask elements 213 interconnecting the tri-elliptical lenses 118 is the dimension P.

With reference to Figure 8 a detailed cross section of the mask 212 of Figure 7 is illustrated showing the tri-elliptical 118 to be formed as part of an elongate strip of optical material 214 made from optical material having a refractive index between 1 and 2.

Particular materials which are suitable include clear plastic; glass, thermoset plastic (CR39); plexiglass; and acrylic resin in the form of methyl methacrylate (which has a specific refractive index of 1.49).

The strip 214 comprises a base elongate portion 215 into which one face has formed the tri-elliptical lens structure 118 and between which planar portions 216 having an opaque strip 217 applied thereover as illustrated in Figure 8.

Figure 9 illustrates an alternative mask 312 suitable for use with any of the previously mentioned embodiments of stereoscopic viewing system. The mask 312 comprises a linear array of spherical cross-section lenses in between which are located opaque joining portions 314 formed as a square cross-section block having a triangular cross section opaque portion 315 located therein as generally illustrated in Figure 9.

The surface of the circular cross-section lenses 313 can be profiled as a set of planar portions forming a segmented planar approximation 316 to a cylindrical or curved surface, also as illustrated in Figure 9.

The above describes only some embodiments of the present invention and modifications, obvious to those skilled in the art, can be made thereto without departing from the scope and spirit of the present invention.

INDUSTRIAL APPLICABILITY

Embodiments of the invention are applicable to stereoscopic viewing systems of many kinds including stereoscopic television systems where it is desired to provide a stereoscopic image to a viewer without the viewer needing to use glasses or other equivalent encumbrances.

CLAIMS

1. A stereoscopic viewing system comprising a raw image overlaid by a mask arranged so that a viewer can resolve a stereoscopic image derived from said raw image in a focal plane of predetermined width located a predetermined distance from said mask.

2. The system of claim 1 wherein said raw image is comprised of alternating left image strips and right image strips, both of pitch P.

3. The system of claim 2 wherein said mask includes vertical lenticular lens strips corresponding to said left and right image strips and arranged to refract light received therefrom so as to cause a stereoscopic image to be resolved by said viewer in said focal plane.

4. The system of claim 3 wherein said mask further includes opaque vertical strips interposed in between said lenticular lens strips.

5. The system of claim 4 wherein said opaque strips are of pitch P and overlay half the width of adjacent left and right image strips.

6. The system of any previous claim wherein said raw image includes raw image opaque strips interposed between said alternating left image strips and right image strips.

7. The system of any previous claim wherein said lenticular lens strips are in the form of tri-elliptical lenses.

8. The system of any previous claim wherein said lenticular lens strips are in the form of a circular cross-section lens.

9. The system of claim 8 wherein said circular cross-section lens is formed as a series of adjacent, planar approximations.

10. The system of any previous claim wherein said mask is formed as a base elongate portion of optical material into a first surface of which are formed lens elements.

11. The system of claim 10 wherein said base elongate portion includes opaque strips placed on said first surface between said lens elements.

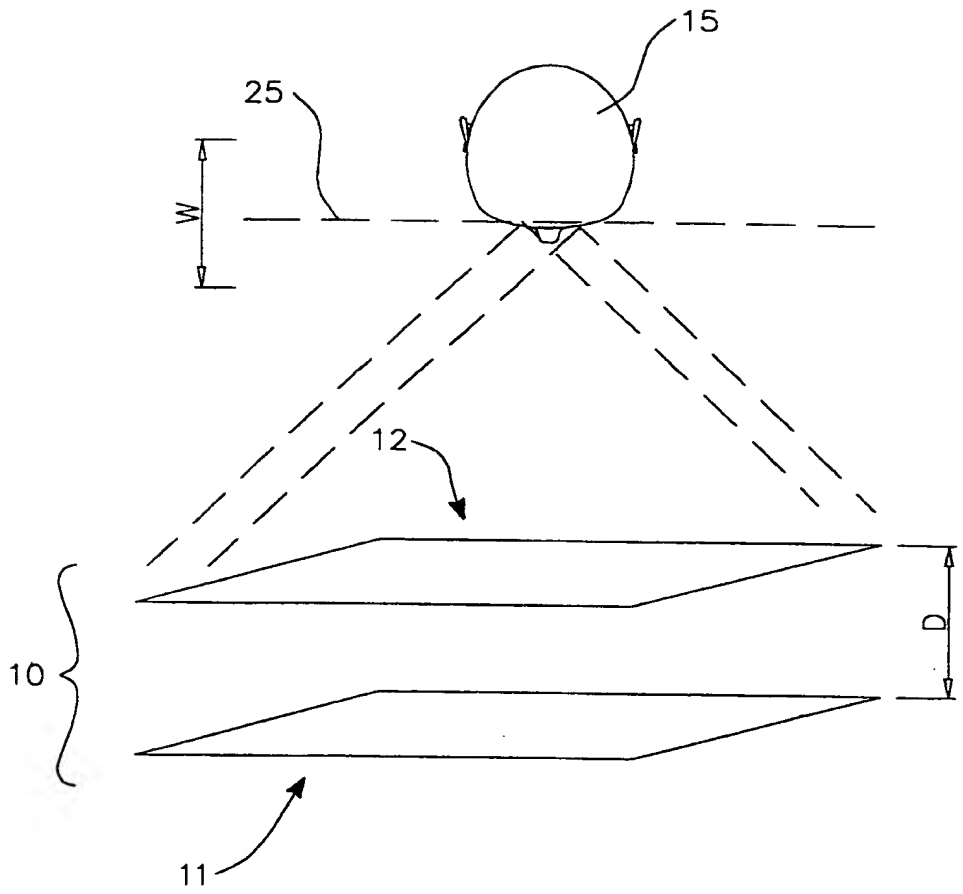

Fig. 1

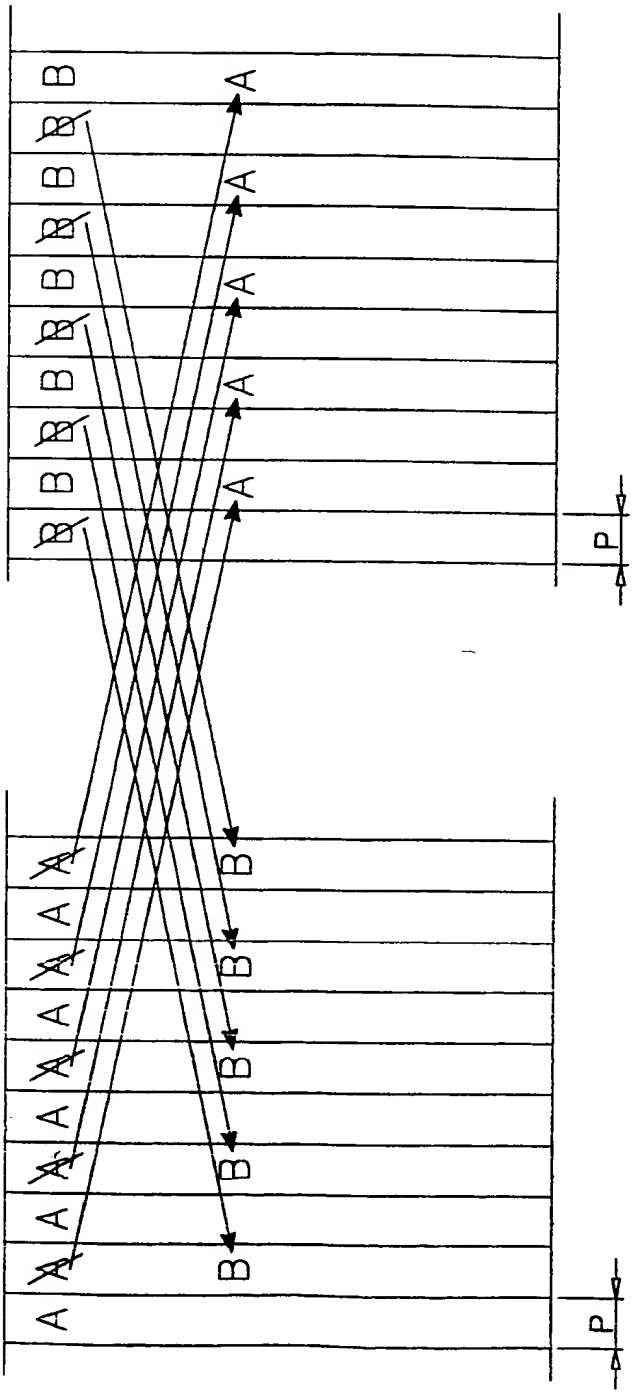

Fig. 2B

Fig. 2A

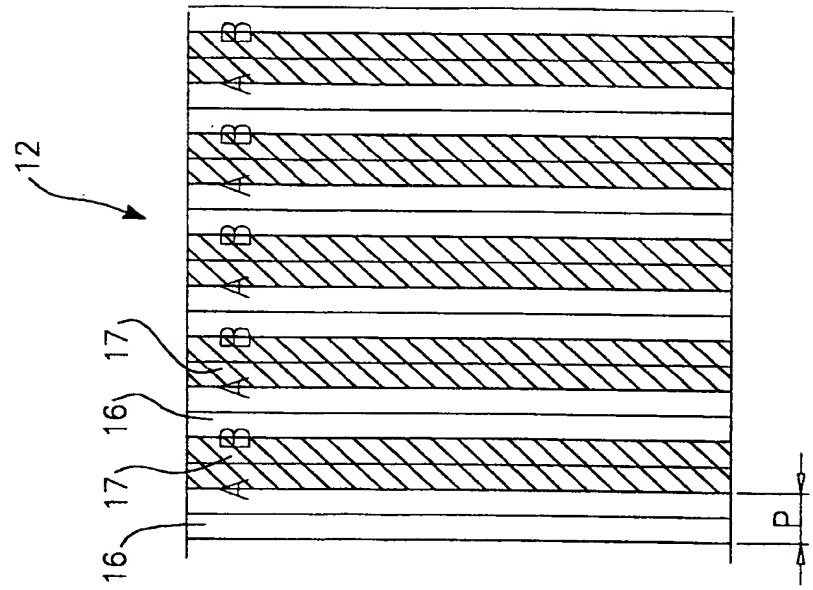

Fig. 3B

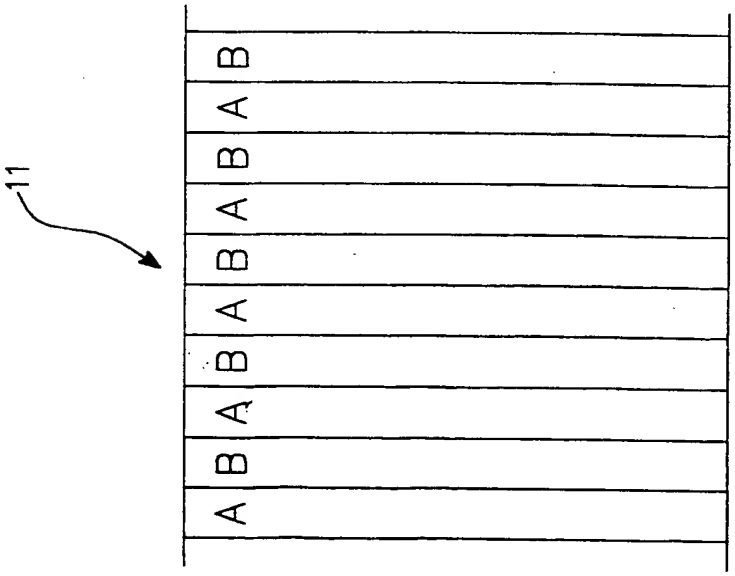

Fig. 3A

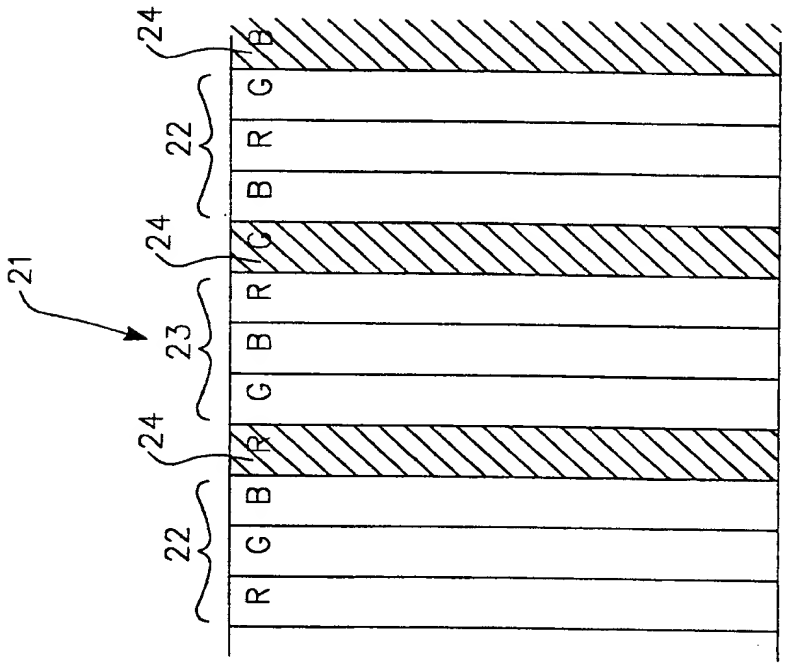

Fig. 4B

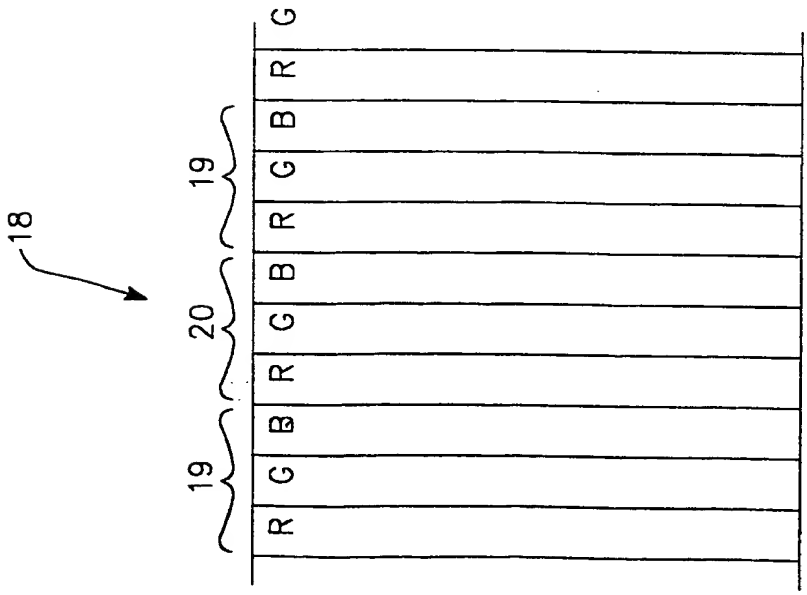

Fig. 4A

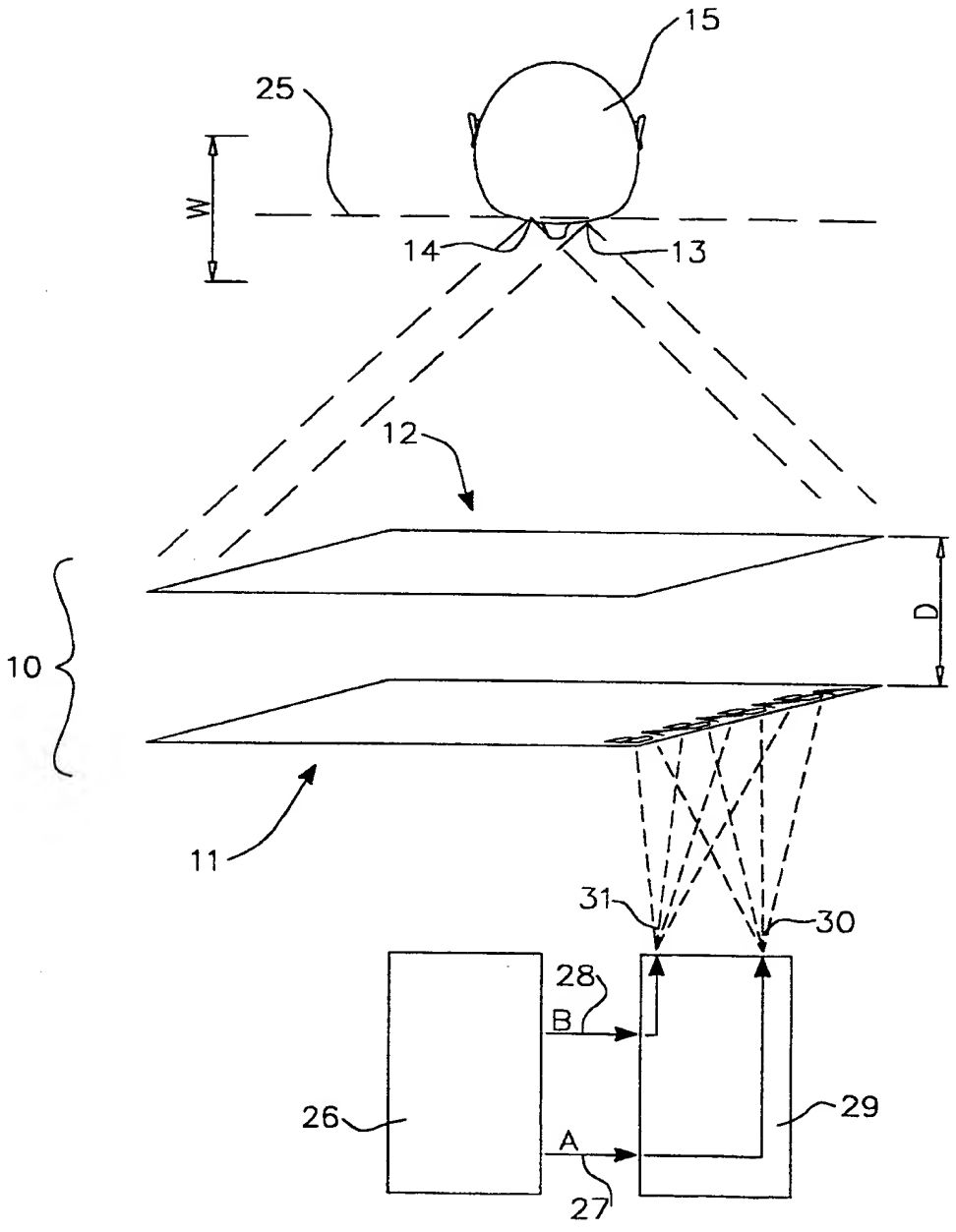

Fig. 5

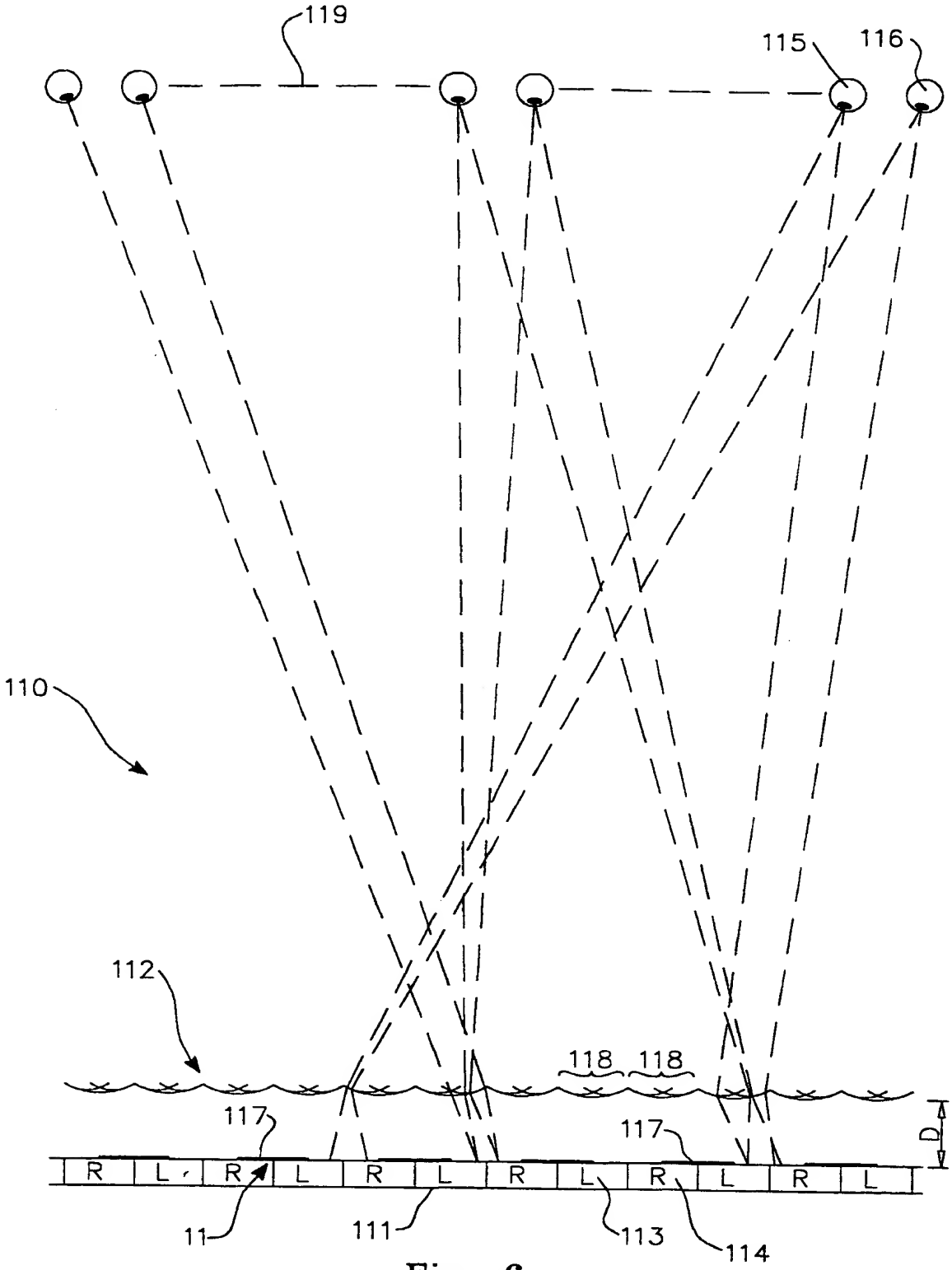
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Fig. 6

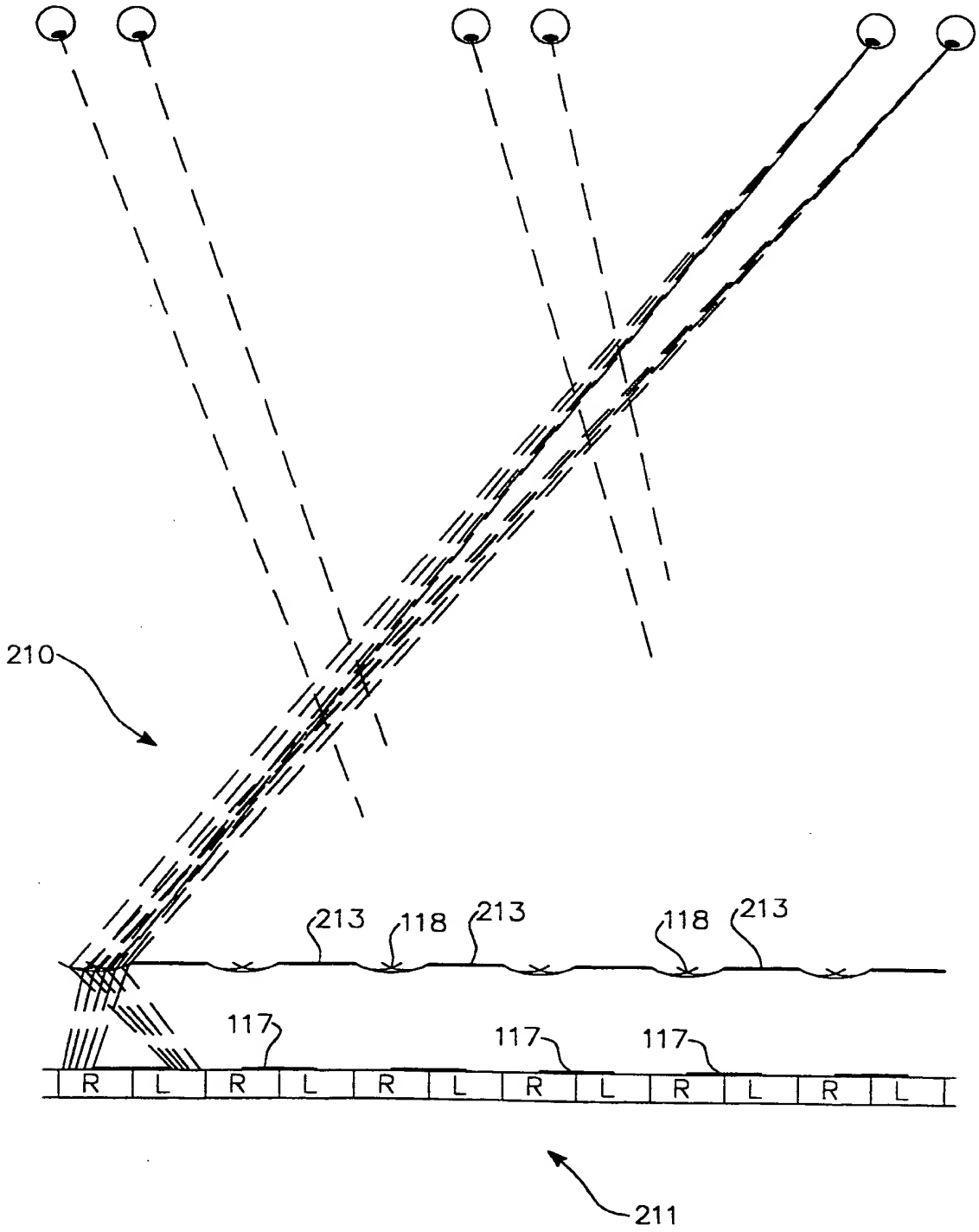

Fig. 7

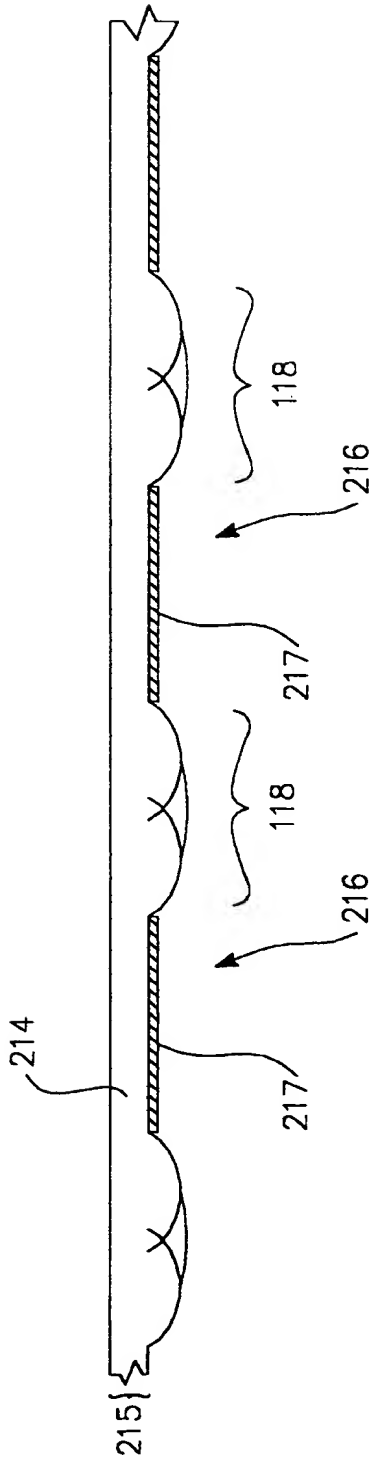

Fig. 8

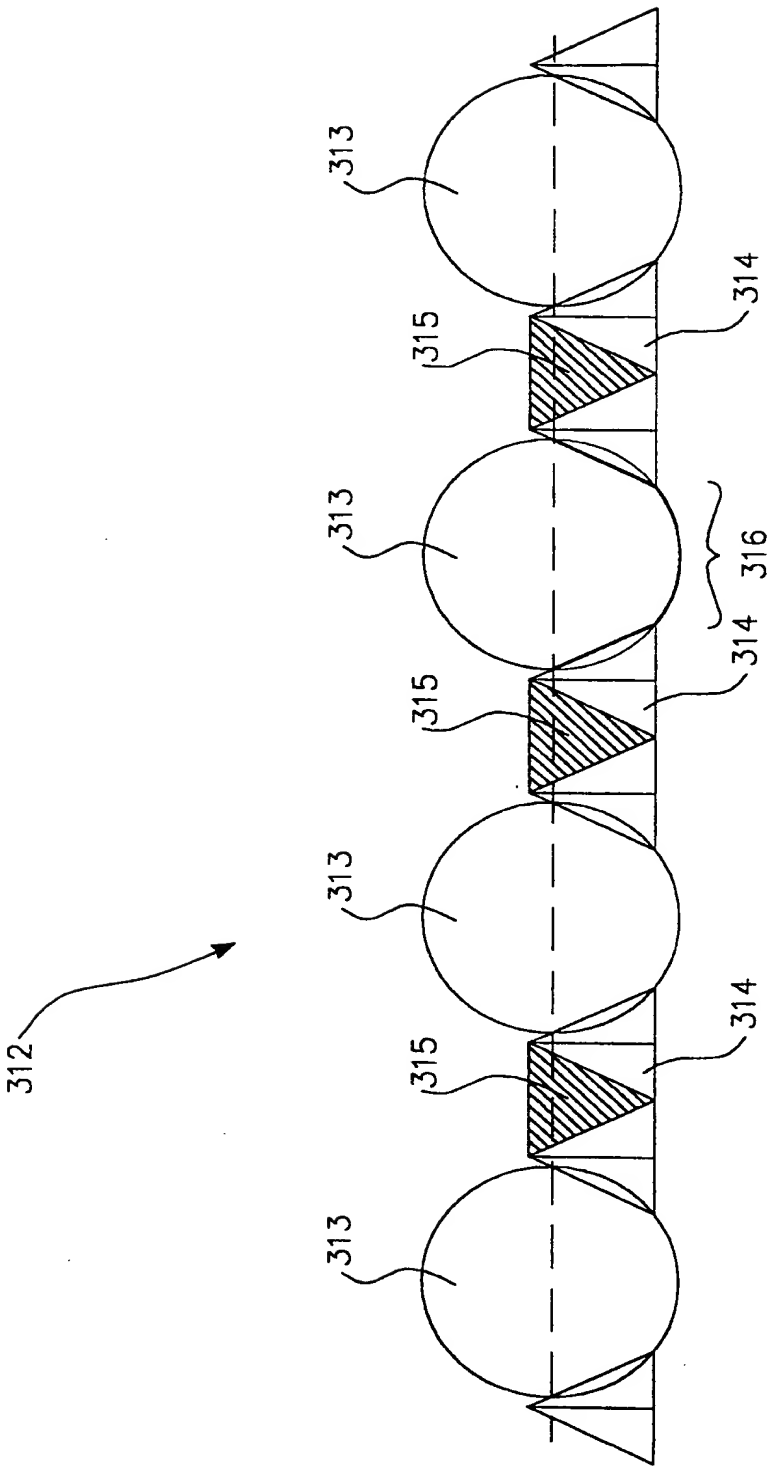

Fig. 9

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU 98/00635

A. CLASSIFICATION OF SUBJECT MATTER

Int Cl[6]: H04N 13/00, 15/00; G02B 27/22; G03B 35/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC H04N 13/00, 15/00, 5/72; G02B 27/22; B44F 7/00; G03B 35/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
AU IPC as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
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JAPIO: STEREOSCOPIC AND IMAGE AND (MASK OR SCREEN OR DIFFUS: OR OPAQUE)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	AU 13076/92 A (SCHENK AG) 15 October 1992 Page 4, line 11 - page 7, line 29; figs 1, 2 and 6	1-9
X	US 5049987A (HOPPENSTEIN) 17 September 1991 Column. 2 line 22-43; col 2. Line 53 - col 3, line 13; col. 7, line 58 - col. 8, line 43	1-9
X	US 4737840A (MORISHITA) 12 April 1988 Column 2, lines 55-65; figs 2-13	1-6

[X] Further documents are listed in the continuation of Box C

[X] See patent family annex

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Authorized officer
SERINEL SAMUEL
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INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU 98/00635

C (Continuation). **DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0762177 A2 (THOMSON MULTIMEDIA) 12 March 1997 Whole document	1-6
Y	EP 0316465 A1 (DIMENSION TECHNOLOGIES, INC) 24 May 1989 Column 3, lines 31-43; figs 3 and 12	1-6
Y	EP 0226155 A2 (MEACHAM, G.B. Kirby) 24 June 1987 Page 2, line 21 - page 3, line 2; claim 1, figs 1 to 4.	1-6

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/AU 98/00635

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member					
AU	92/13076	US	5258833				
US	5049987	AU	64487/90	EP	447519	WO	9106184
US	4737840	JP	60031127	US	4872750	JP	60031387
		JP	59013488				
EP	762177	GB	2304921	JP	9133893		
EP	226115	US	4740073	JP	62208790	CA	1245890
		EP	114406	JP	59210436		

END OF ANNEX

09/485500

Replaced by Amd B4

WO 99/09750

STEREOSCOPIC VIEWING SYSTEM

The present invention relates to a stereoscopic viewing system and, more particularly, to such a system adapted for viewing a stereoscopic image without the aid of spectacles or similar image separating device located close to the eyes of a viewer.

BACKGROUND

Forms of stereoscopic television/video systems which provide stereoscopic viewing without the use of glasses or other encumbrances placed close to the eyes of a viewer are known. Once such system is the so-called lenticular system wherein the image for viewing is made up of interleaved vertical image strips from two (left image and right image) camera views. In order to allow the eyes to resolve the two images into a single stereoscopic image, lenses in the form of vertically arranged contiguous cylindric lenses overlay the vertical image strips whereby, by refraction, the left image is directed towards the left eye of a viewer and the right image is directed towards the right eye of a viewer when the eyes are placed in a predetermined focal plane, or very near thereto. U.S. Patent No. 5,258,833 to Schenk describes this general background with reference to U.S. Patent No. 4,214,257 (Yamauchi) and U.S. Patent No. 2,543,793 (Marks). The systems described in those patents suffer from a sensitivity in the location of the focal plane for viewing and suffer from a large amount of light scatter.

It is an object of the present invention to ameliorate the above-mentioned problem and/or at least provide a useful alternative.

BRIEF DESCRIPTION OF INVENTION

Accordingly, in one broad form of the invention, there is provided a stereoscopic viewing system comprising a raw image overlaid by a mask arranged so that a viewer can resolve a stereoscopic image derived from said raw image in

a focal plane of predetermined width located a predetermined distance from said mask.

Preferably said raw image is comprised of alternating left image strips and right image strips on both of pitch P.

Preferably said mask includes vertical lenticular lens strips corresponding to said left and right image strips and arranged to refract light received therefrom so as to cause a stereoscopic image to be resolved by said viewer in said focal plane.

Preferably said mask further includes opaque vertical strips interposed in between said lenticular lens strips.

Preferably said opaque strips are of pitch P and overlay half the width of adjacent left and right image strips.

Preferably said raw image includes raw image opaque strips interposed between said alternating left image strips and right image strips.

Preferably said lenticular lens strips are in the form of tri-elliptical lenses.

In an alternative preferred form said lenticular lens strips are in the form of a circular cross-section lens.

Preferably said circular cross-section lens is formed as a series of adjacent, planar approximations.

Preferably said mask is formed as a base elongate portion of optical material into a first surface of which are formed lens elements.

Preferably said base elongate portion includes opaque strips placed on said first surface between said lens elements.

BRIEF DESCRIPTION OF DRAWINGS

Embodiments of the invention will now be described with reference to the accompanying drawings wherein:-

Figure 1 illustrates the general layout of a stereoscopic viewing system to which embodiments of the present invention can be applied;

Figure 2 illustrates steps in the formation of a raw stereoscopic image to which a first embodiment of the invention can be applied;

Figure 3 illustrates a mask applicable to the raw image of Figure 2 according to a first embodiment of the invention;

Figure 4 illustrates a mask applicable to a flat panel or plasma display;

Figure 5 illustrates a specific driver circuit for the production of an active raw image;

Figure 6 illustrates an arrangement of raw image and mask according to a further embodiment of the invention;

Figure 7 illustrates a raw image and mask layout according to a further embodiment of the invention;

Figure 8 is a detailed view in cross section of the mask of Figure 7; and

Figure 9 is a detailed view in side section of a mask according to a further embodiment of the invention.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

With reference to Figure 1, there is shown a stereoscopic viewing system 10 comprising a raw image 11 and a mask 12. The mask 12 includes an optical arrangement whereby light rays from the raw image 11 are directed to either the left eye 13 or right eye 14 of a viewer 15 so as to form a three-dimensional image to the viewer.

With reference to Figures 2A and 2B, the raw image 11 is formed as follows:-

A stereoscopic image is generated initially as two separate images comprising a left eye view and a right eye view. The left eye view is labelled image A whilst the right eye view is labelled image B. Each image is then divided up into vertical strips of pitch P. Figure 2A represents the left image thus partitioned. Figure 2B represents the right eye image thus partitioned. Consecutive strips are then interchanged between the two images as indicated by the arrows thereby to produce a raw image 11 which combines both the left and right images in it in alternating strips as shown.

The raw image may be in the form of a photograph or like 'passive'/reflective image source or it may be in the form of a video display or like 'active'/light emitting image source. In either case, light reflected from or light emanating from the raw image needs to be optically processed through a mask 12 so as to redirect the light rays for reconstruction by eyes 13, 14.

EP744872 discloses a particular implementation of this kind of stereoscopic image system wherein the mask 12 (termed barrier 2 in EP744872) is an electronically controlled shutter mechanism which can dynamically switch and direct the respective right and left images to the respective right and left observer eyes.

As previously discussed the light refracting element of a "lenticular" system more often includes a lens such as lens element 48 shown, for example, in Figure 31A of EP744872.

The particular implementation illustrated in Figs. 2A and 2B shows strip widths for the alternating left eye images A and right eye images B of width or pitch P. A good summary of the history and implementation of this kind of system is to be found in IEEE publication "Present Status of Three-Dimensional Television Research" in Proceedings of IEEE volume 83, No 7 July 1995.

With reference to Figure 3 an implementation of the mask 12 according to a first embodiment of the invention is illustrated. Specifically Figure 3A shows the raw image 11 to which the mask 12 of Figure 3B is applied or overlaid, and including opaque strips 17 as illustrated. The displacement or distance D between the raw image 11 and the mask 12 can, according to the implementation, vary between 0 and typically around 2-13cms depending on the nature of the light refracting element used to form the lens strips 16.

The raw image 11 of Figure 3A comprising alternating vertical strips of left image A and right image B is overlaid by the mask generally illustrated in Figure 3B. The mask comprises vertical lens strips 16 of pitch P arranged to overlay a half-width of a left image strip and a half-width of a right image strip. The lens strips 16 are of the lenticular type and can be constructed in the manner described in U.S. Patent No. 5,258,833.

Interposed between the lens strips 16 are opaque strips 17, also of pitch P and also arranged so as to overlay a half-width of adjacent left image strips and right image strips A, B as generally illustrated in Figure 3B.

With reference to Figure 4, the manner of construction of a colour raw image 18 is illustrated in Figure 4A and comprises alternating left image colour strips 19 and right image colour strips 20. Each image strip is, itself, comprised of three primary colour strips labelled R (red) G (green) and B (blue). The corresponding colour mask 21 is illustrated in Figure 4B and comprises left vertical lens strips 22 and alternating right vertical lens strips 23, each constructed according to the lenticular methods previously known. In addition, an opaque strip 24 is placed, as illustrated in Figure 4B immediately between adjacent vertical lens strips 22, 23 and, correspondingly, 23, 22. The pitch of the opaque strip 24 is such as to cover a primary colour strip, a different colour strip in each consecutive occurrence.

In this manner, it will be noted that the opaque strips remove some redundant image information according to a predetermined algorithm. The effect, it is postulated, is to widen the width W of the focal plane 25 of viewer 15 in which a stereoscopic image can be resolved.

Figure 5 illustrates a driver arrangement suitable for use with the embodiments of the invention where an active display (such as a CRT, LEDs or back lit matrix) wherein a parallax image source 26 resolves a stereoscopic image comprising a left eye image A and a right eye image B into an A data stream 27 and a B data stream 28 which are fed to screen driver 29 which resolves the data streams 27, 28 into respective vertical strip data streams 30, 31 which are directed to the respective vertical strips comprising raw image 11.

Figure 6 illustrates in plan view a further embodiment of the invention comprising raw image 111 made up of respective left image strips 113 and right image strips 114, all of equal width or pitch P and having opaque strips 117 or width or pitch P laid thereover on the viewing side as illustrated in Figure 6. Specifically the opaque strips 117 are of width or pitch P and are arranged so that each overlies half of the area of adjoining left and right image strips 113, 114.

In addition the stereoscopic viewing system 110 includes mask 112 comprised of a linear array of tri-elliptical lenses 118. Each tri-elliptical 118 is itself formed from three intersecting strip lenses of ellipsoid cross-section as perhaps best seen in detail in Figure 8. The function of each of these lenses 118 is as typically found in "lenticular" stereoscopic systems, being to refract the light received from collective left image strips 113 to a left eye 115 of a viewer and to also refract (bend) the light received from collective right image strips 114 to the right eye 116 of a viewer when located in a specified focal plane 119.

In this embodiment the lenses 118 are contiguously connected in a linear array as illustrated in Figure 6. The only masking of light information is performed by opaque strips 117 located, in this instance, directly on the raw image 111 as illustrated.

Figure 7 illustrates a further embodiment of the invention comprising a stereoscopic viewing system 210 having a raw image 211 and a mask 212 but wherein all other components are numbered as for the embodiment of Figure 6 where like components are utilised.

In this embodiment opaque mask elements are placed between each tri-elliptical lens 118 in the manner illustrated in Figure 7. The opaque strips 117 are also utilised applied directly to the raw image 211.

In this instance the width of the opaque mask elements 213 interconnecting the tri-elliptical lenses 118 is the dimension P.

With reference to Figure 8 a detailed cross section of the mask 212 of Figure 7 is illustrated showing the tri-elliptical 118 to be formed as part of an elongate strip of optical material 214 made from optical material having a refractive index between 1 and 2.

Particular materials which are suitable include clear plastic; glass, thermoset plastic (CR39); plexiglass; and acrylic resin in the form of methyl methacrylate (which has a specific refractive index of 1.49).

The strip 214 comprises a base elongate portion 215 into which one face has formed the tri-elliptical lens structure 118 and between which planar portions 216 having an opaque strip 217 applied thereover as illustrated in Figure 8.

Figure 9 illustrates an alternative mask 312 suitable for use with any of the previously mentioned embodiments of stereoscopic viewing system. The mask 312 comprises a linear array of spherical cross-section lenses in between which are located opaque joining portions 314 formed as a square cross-section block having a triangular cross section opaque portion 315 located therein as generally illustrated in Figure 9.

The surface of the circular cross-section lenses 313 can be profiled as a set of planar portions forming a segmented planar approximation 316 to a cylindrical or curved surface, also as illustrated in Figure 9.

The above describes only some embodiments of the present invention and modifications, obvious to those skilled in the art, can be made thereto without departing from the scope and spirit of the present invention.

INDUSTRIAL APPLICABILITY

Embodiments of the invention are applicable to stereoscopic viewing systems of many kinds including stereoscopic television systems where it is desired to provide a stereoscopic image to a viewer without the viewer needing to use glasses or other equivalent encumbrances.

CLAIMS

1. A stereoscopic viewing system comprising a raw image overlaid by a mask arranged so that a viewer can resolve a stereoscopic image derived from said raw image in a focal plane of predetermined width located a predetermined distance from said mask.

2. The system of claim 1 wherein said raw image is comprised of alternating left image strips and right image strips, both of pitch P.

3. The system of claim 2 wherein said mask includes vertical lenticular lens strips corresponding to said left and right image strips and arranged to refract light received therefrom so as to cause a stereoscopic image to be resolved by said viewer in said focal plane.

4. The system of claim 3 wherein said mask further includes opaque vertical strips interposed in between said lenticular lens strips.

5. The system of claim 4 wherein said opaque strips are of pitch P and overlay half the width of adjacent left and right image strips.

6. The system of any previous claim wherein said raw image includes raw image opaque strips interposed between said alternating left image strips and right image strips.

7. The system of any previous claim wherein said lenticular lens strips are in the form of tri-elliptical lenses.

8. The system of any previous claim wherein said lenticular lens strips are in the form of a circular cross-section lens.

9. The system of claim 8 wherein said circular cross-section lens is formed as a series of adjacent, planar approximations.

10. The system of any previous claim wherein said mask is formed as a base elongate portion of optical material into a first surface of which are formed lens elements.

11. The system of claim 10 wherein said base elongate portion includes opaque strips placed on said first surface between said lens elements.

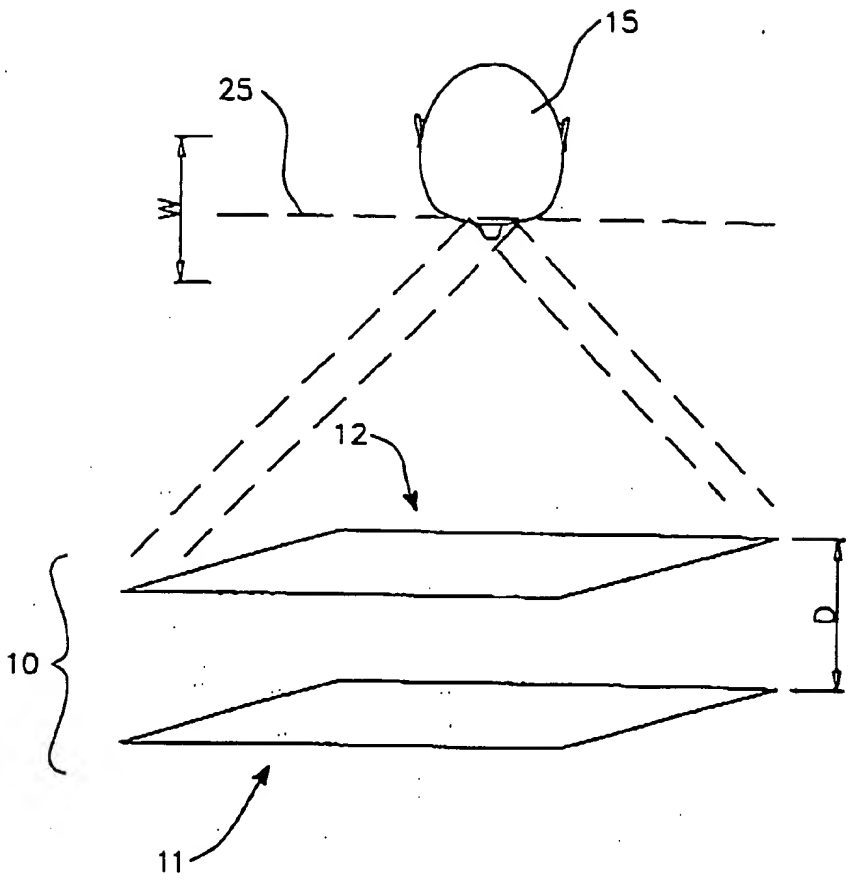

Fig. 1

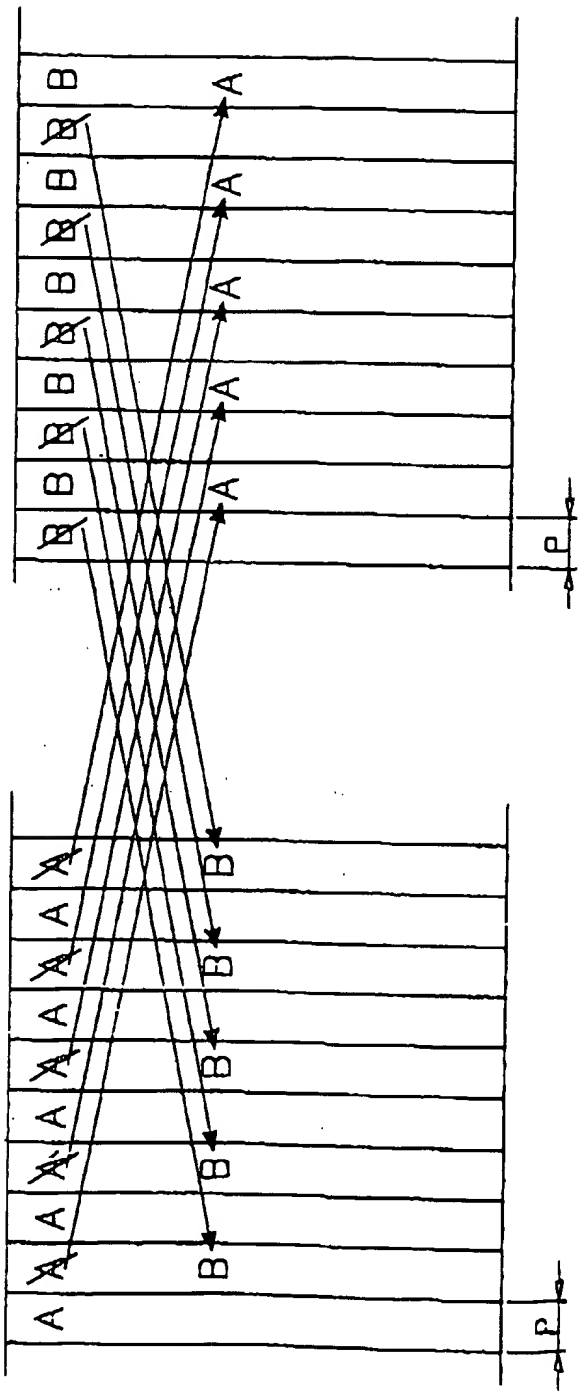

Fig. 2B

Fig. 2A

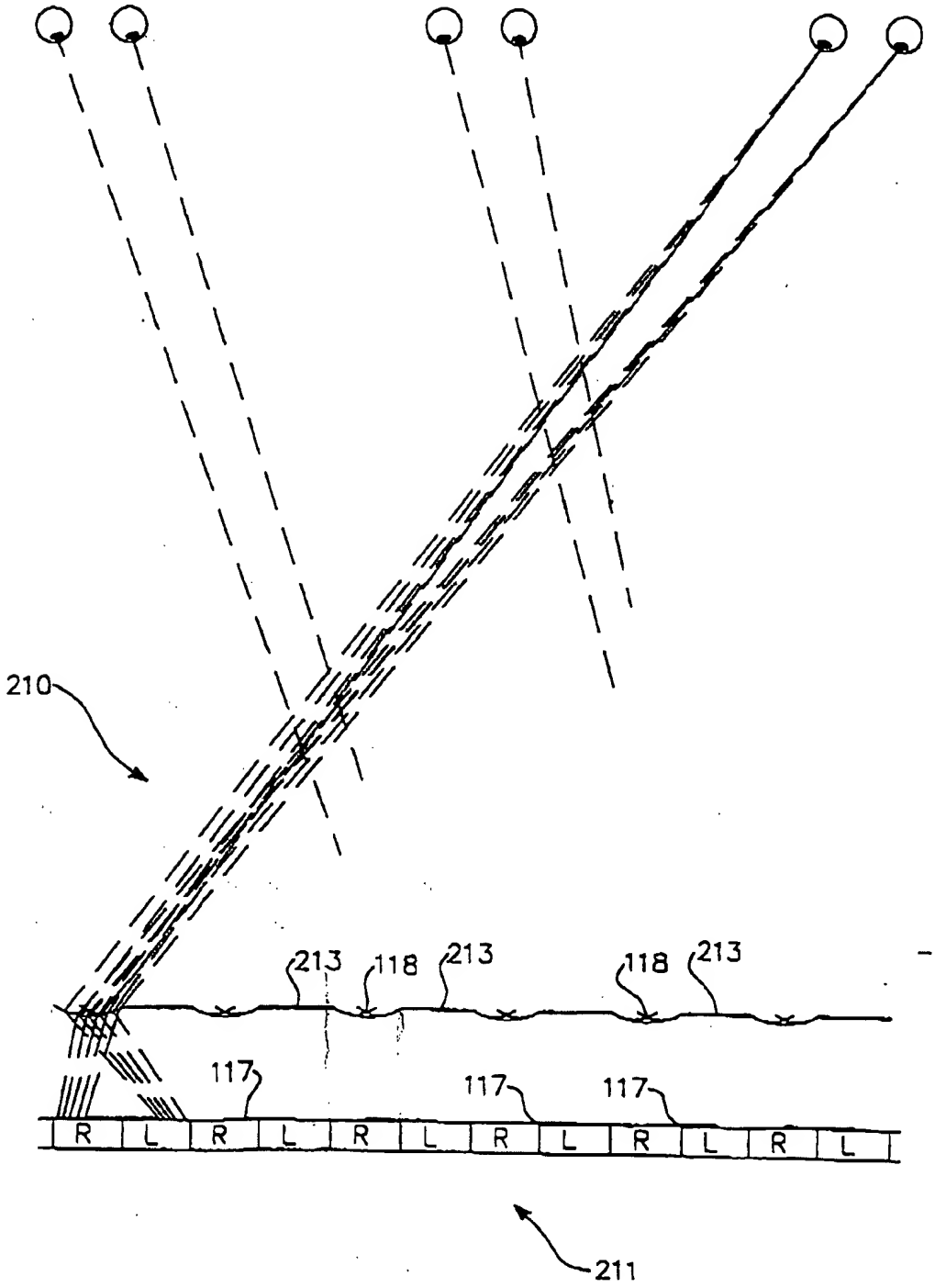

Fig. 7

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STEREOSCOPIC VIEWING SYSTEM

The present invention relates to a stereoscopic viewing system and, more particularly, to such a system adapted for viewing a stereoscopic image without the aid of spectacles or other image separating device located close to the eyes of a viewer.

BACKGROUND

Forms of stereoscopic television/video systems which provide stereoscopic viewing without the use of glasses or other encumbrances placed close to the eyes of a viewer are known. One such system is the so-called lenticular system wherein the image for viewing is made up of interleaved vertical image strips from two (left image and right image) camera views. In order to allow the eyes to resolve the two images into a single stereoscopic image, lens in the form of vertically arranged contiguous cylindric lens, or lens of other shapes, such as prisms, overlay the vertical image strips whereby, by refraction, the left image is directed towards the left eye of a viewer and the right image is directed towards the right eye of a viewer when the eyes are placed in a predetermined focal plane, or very near thereto. U.S. Patent No. 5,258,833 to Schenk describes this general background with reference to U.S. Patent No. 4,214,257 (Yamauchi) and U.S. Patent No. 2,543,793 (Marks). EP744872 discloses another implement action of stereoscopic image system wherein an electronically controlled shutter mechanism dynamically switches and direct the respective right and left images to the respective right and left eyes of an observer.

The light refracting element of a "lenticular" system often includes a lens such as lens element 48 shown, for example, in Figure 31A of EP744872. A good summary of the history and implementation of this kind of system is to be found in IEEE publication "Present Status of Three-Dimensional Television Research" in Proceedings of IEEE volume 83, No 7 July 1995. The systems described in those patents suffer from a sensitivity in the location of the focal plane for viewing and suffer from a large amount of light scatter which leads to distortion of the viewed image.

It is therefore desirable to ameliorate the above-mentioned problems and/or at least provide a useful alternative.

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It is also desirable to provide a improved stereoscopic viewing system which enables an image to viewed as a 3D image from a plurality of positions along or adjacent a focal plane.

It is also desirable to provide an improved stereoscopic image system which can be adapted for use with passive, reflective image sources, such as photographs, drawings or the like as well as active, light emitting image sources such as television screen, video displays or any other form of light emitting or light iminating optical systems.

It is also desirable to provide an improved stereoscopic viewing system which is relatively simple in its construction and implementation and is economical in use to provide the desired three dimensional image to a viewer.

SUMMARY OF THE INVENTION

According to one aspect of the invention there is provided a stereoscopic viewing system comprising a raw image of a subject, which raw image comprises an array of substantially vertical raw image strips wherein alternating strips are respectively strips taken from source images, being a right eye view image and a left eye view image of the subject, an array of substantially vertical lens strips interposed between the raw image and a focal plane spaced from the raw image, wherein the respective lens strips are positioned to receive light from the raw image strips and refract that received light to cause a stereoscopic image of the subject to be resolved on the focal plane, and masking means comprising a substantially planar array of vertical opaque strips interposed between the raw image and the said focal plane.

In one preferred embodiment of the invention, the source images are divided into adjacent vertical strips and those strips which are taken for the raw image strips comprise every other one of said respective image strips. Thus, the raw image is comprised of alternating left image strips and right image strips with each other one of the left and right source image strips being omitted.

In one embodiment of the invention, the masking means is disposed on the raw image. In another embodiment of the invention, the masking means is disposed on the lens strip of array. In a further embodiment of the invention, the masking means

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comprises a separate mask member disposed between and spaced from the raw image and lens strip array.

In an embodiment of the invention, the vertical opaque strips forming the masking means are of substantially the same width as the said raw image strips and the vertical opaque strips have their centre lines respectively in register with alternate lines of junction between raw image strips. In this embodiment, the vertical lens strips are also of substantially the same width as the raw image strips and have their centre lines respectively in register with other alternate lines of junction between raw image strips.

In another embodiment of the invention, the raw image strips each contain three columns of pixels of different colours, for example Red, Green and Blue. In this embodiment, the opaque strips are of the same width as an individual pixel column while the lens strips are of a width equal to the width of the three columns. The opaque strips are spaced apart a distance equal to the width of the three columns.

The array of substantially vertical lens strips may be said to constitute a lenticular lens. Each individual lens may have a cylindric shape or, more preferably, be in the form of tri-elliptical lens. Alternatively, the lens may be of prismatic or other form to provide the desired refraction of received light.

In another form of the invention, each lens of the lenticular lens structure has a circular cross-section and is separated from adjacent lens by an opaque strip.

In a further form of the invention, the masking means is combined with the array of substantially vertical lens strips in such a way that the mask is formed as a base elongate portion of optical material into a first surface of which are formed spaced lens strips with the spaces between the strips being of the base optical material.

BRIEF DESCRIPTION OF DRAWINGS

Embodiments of the invention will now be described with reference to the accompanying drawings wherein:-

Figure 1 illustrates the general layout of a stereoscopic viewing system to which embodiments of the present invention can be applied;

Figure 2 illustrates steps in the formation of raw stereoscopic image to which a first embodiment of the invention can be applied;

Figure 3 illustrates a mask applicable to the raw image of Figure 2 according to the first embodiment of the invention;

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Figure 4 illustrates a mask applicable to a flat panel or plasma display;

Figure 5 illustrates a specific driver circuit for the production of an active raw image;

Figure 6 illustrates an arrangement of raw image and mask according to a further embodiment of the invention;

Figure 7 illustrates a raw image and mask layout according to a further embodiment of the invention;

Figure 8 is a detailed view in cross section of the lenticular lens of Figure 7; and

Figure 9 is a detailed view in side section of a lenticular lens incorporating a mask according to a further embodiment of the invention.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

With reference to Figure 1, there is shown a stereoscopic viewing system 10 comprising a raw image 11 and a lenticular lens 12 spaced form the raw image 11 a distance D. The lens 12 includes an optical arrangement whereby light rays from the raw image 11 are directed to either the left eye 13 or right eye 14 of a viewer 15 so as to form a three-dimensional image to the viewer. As herein after describes, the eyes of the viewer 15 will be located on a focal plane 25 or adjacent that focal plane such as indicated by the focal plane Width.

With reference to Figure 2, the raw image 11 is formed as follows:-

A stereoscopic raw image 11 is generated initially as two separate images comprising a left eye view 3 and a right eye view 4. The left eye view 3 is labelled image A whilst the right eye view 4 is labelled image B. Each image is then divided up into vertical strips 1 to 9 of equal pitch P. Alternate strips are then taken from the two images 3 and 4 as indicated by the arrows, emitting each second strip from each image 3 and 4. Thus, the strips A1, A3, A5,.... are interleaved with the strips B2, B4, B6, B8... to produce the composite raw image 11. It will therefore be understood that the raw image 11, in this embodiment of the invention, comprises alternate strips taken from the left eye view image 3 and the right eye view image 4, and while parts of the left eye and right eye images are omitted from the final raw image 11, the viewer is unable to discern missing parts of the image.

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The raw image "may be in the form of a photograph or like 'passive'/reflective image source or it may be in the form of a video display or like 'active'/light emitting image source. In either case, light reflected from or light emanating from the raw image" needs to be optically processed through a lenticular lens 12 so as to redirect the light rays for reconstruction by eyes 13, 14.

With reference to Figure 3 an implementation of a mask 17 according to the first embodiment of the invention is illustrated. Specifically Figure 3A shows the raw image 11 produced as described above and to which the mask 17 of Figure 3B is applied or overlaid.

The mask 17 comprises a plurality of opaque strips which overlie the alternate lines of junction between the raw image strips 16. The mask may either be applied directly to the raw image 11, as illustrated in the embodiments shown in Figures 6 and 7, or may be applied to or form part of the lenticular lens 12, as illustrated in Figures 8 and 9. Alternatively, the mask 17 may be a separate mask member interposed either between the raw image 11 and the lenticular lens 12 or between the lenticular lens 12 and the focal plane 25. Irrespective of its physical location, the mask effectively blocks light from the raw image 11 thereby facilitating the separation of left hand and right hand images to the respective left and right eyes of an observer.

If the mask 17 is incorporated into the lenticular lens 12, or constitutes a separate mask member, the displacement or distance D between the raw image 11 and the mask 17 can vary between 0 and typically around 2-14cms depending on the nature of the light refracting element used to form the lenticular lens 12.

With reference to Figure 4, the manner of construction of a colour raw image 18 is illustrated in Figure 4A and comprises alternating left image colour strips 19 and right image colour strips 20. Each image strip is, itself, comprised of three primary colour strips labelled R (red) G (green) and B (blue). The corresponding colour mask 21 is illustrated in Figure 4B and comprises opaque strip 24 which is of a width corresponding to the width of one of the primary colour strips labelled R, G and B. The opaque strips 24 are spaced apart a distance equalled to the width of the colour strips 19 and 20 so that the opaque strips 24 mask a red primary coloured strip R of one colour image strip 19, the green primary coloured strip green of the next colour strip 20, the blue primary colour strip B of the next colour strip 19, etc. Thus, the masking masks

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portion only of the alternating left and right image colour strips 19 and 20, but in such a way as to mask each of the three primary colour strips R, G and B in turn across the width of the raw image 18.

The opaque strips 24 may be incorporated with a lenticular lens 21 and extend between adjacent vertical lens strips 22 and 23 which are spaced apart by the width of the opaque strip 24. With this arrangement, the vertical lens strips 22 and 23 may be formed as tri-elliptical lens with each part specifically formed to refract one of the primary colour strips R, G or B.

The pitch of the opaque strip 24 is such as to cover a primary colour strip, a different colour strip in each consecutive occurrence. In this manner, it will be noted that the opaque strips remove some redundant image information according to a predetermined algorithm. The effect, it is postulated, is to widen the width W of the focal plane 25 of viewer 15 in which a stereoscopic image can be resolved.

Figure 5 illustrates a driver arrangement suitable for use with embodiments of the invention where an active display (such as CRT, LEDs or back lit matrix) is used wherein a parallax image source 26 resolves a stereoscopic image comprising a left eye image A and a right eye image B into an A data stream 27 and a B data stream 28 which are fed to screen driver 29 which resolves the data streams 27, 28 into respective vertical strip data streams 30, 31 which are directed to the respective vertical strips comprising raw image 11.

Figure 6 illustrates in plan view a further embodiment of the invention comprising raw image 111 made up of respective left image strips 114 and right image strips 114, all of equal width or pitch P and having a mask formed of opaque strips 117 of width or pitch P laid thereover on the viewing side as illustrated in Figure 6. Specifically the opaque strips 117 are arranged so that each overlies half of the area of adjoining left and right image strips 113, 114.

In addition the stereoscopic viewing system 110 includes a lenticular lens system 112 comprised of a linear array of tri-elliptical 118 is itself formed from three intersecting strip lenses of ellipsoid cross-section as perhaps best seen in detail in Figure 8. The function of each of these lenses 118 is as typically found in "lenticular" stereoscopic systems, being to refract the light received from collective left image strips 113 to a left eye 115 of a viewer and to also refract (bend) the light received from

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collective right image strips 114 to the right eye 116 of a viewer when located in a specified focal plane 119.

In this embodiment the lenses 118 are contiguously connected in a linear array as illustrated in Figure 6. The only masking of light information is performed by the opaque strips 117 located, in this instance, directly on the raw image 111 as illustrated.

Figure 7 illustrates a further embodiment of the invention comprising a stereoscopic viewing system 210 having a raw image 211 and a lenticular lens 212 wherein all other components are numbered as for the embodiment of Figure 6 where like components are utilised.

In this embodiment, the mask comprises both the opaque mask strips 117 which are applied directly to the raw image 212 as shown in Figure 6 as well as separate opaque mask elements 213 which are placed on the lenticular lens 212 between each tri-elliptical lens 118. With this form of masking, a reduction in the refracted light passing through the lenticular lens 212 increases the separation effect between the left hand raw image and the right hand raw image.

In this instance the width of the opaque mask elements 213 interconnecting the tri-elliptical lenses 118 is the dimension P.

With reference to Figure 8 a detailed cross section of the mask 212 of Figure 7 is illustrated showing the tri-elliptical lenses to be formed as part of an elongate strip of optical material 214 made form optical material having a refractive index between 1 and 2.

Particular materials which are suitable include clear plastic; glass, thermoset plastic (CR39); plexiglass; and acrylic resin in the form of methyl methacrylate (which has a specific refractive index of 1.49).

The strip 214 comprises a base elongate portion 215 into which one face has formed the tri-elliptical lens structure 118 and between which planar portions 216 having an opaque strip 217 applied thereover as illustrated in Figure 8.

Figure 9 illustrates an alternative lens 312 suitable for use with any of the previously mentioned embodiments of stereoscopic viewing system. The lens 312 comprises a linear array of spherical cross-section lenses 313 in between which are located opaque joining portions 314 formed as a square cross-section block having a

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triangular cross section opaque portion 315 located therein as generally illustrated in Figure 9.

The surface of the circular cross-section lenses 313 can be profiled as a set of planar portions forming a segmented planar approximation 316 to a cylindrical or curved surface.

The above describes only some embodiments of the present invention and modifications, obvious to those skilled in the art, can be made thereto without departing from the scope and spirit of the present invention.

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CLAIMS

1. A stereoscopic viewing system comprising a raw image of a subject, which raw image comprises an array of substantially vertical raw image strips wherein alternating strips are respectively strips taken from source images, being a right eye view image and a left eye view image of the subject, an array of substantially vertical lens strips interposed between the raw image and a focal plane spaced from the raw image, wherein the respective lens strips are positioned to receive light from the raw image strips and refract that received light to cause a stereoscopic image of the subject to be resolved on the focal plane, and masking means comprising a substantially planar array of vertical opaque strips interposed between the raw image and the said focal plane.

2. A stereoscopic viewing system according to claim 1 wherein, in forming the array of raw image strips, the right eye source image and the left eye source image are both divided into adjacent vertical strips, and those strips taken for the raw image strips comprise every alternate one of said respective source image strips so that every other one of the source image strips is omitted from the raw image.

3. A stereoscopic viewing system according to claim 1 or claim 2 wherein, for a monochrome image, the vertical opaque strips are of substantially the same width as that of said raw image strips and have their centre lines respectively in register with alternate lines of junction between raw image strips, and the vertical lens strips are also of substantially the same width and have their centre lines respectively in register with other alternate lines of junction between raw image strips.

4. A stereoscopic viewing system according to claim 1 or claim 2 wherein, for a colour image, the raw image strips each contain a trio of columns of respectively R G and B pixels, that the lens strips are as wide as the trio and the opaque strips are of the same width as the individual R G and B pixel columns and are disposed between the lens strips.

5. A stereoscopic viewing system according to any one of claims 1 to 3 wherein the masking means is in contact with the raw image.

6. A stereoscopic viewing system according to any one of claims 1 to 4 wherein the opaque strip array is substantially co-planar with the lens strip array.

7. A stereoscopic viewing system according to any one of claims 1 to 6 wherein the array of lens strips comprises a lenticular lens system in which each lens is of a tri-elliptical cross-section.

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8. A stereoscopic viewing system according to any one of claims 1 to 6 wherein the array of lens strips comprises a lenticular lens system in which each lens is of a circular cross-section.

9. A stereoscopic viewing system according to any one of claims 1 to 8 wherein the mask means comprises a separate mask member between the raw image and the lens strips.

10. A stereoscopic viewing system substantially as hereinbefore described with reference to the accompanying drawings.

ARTICLE 19

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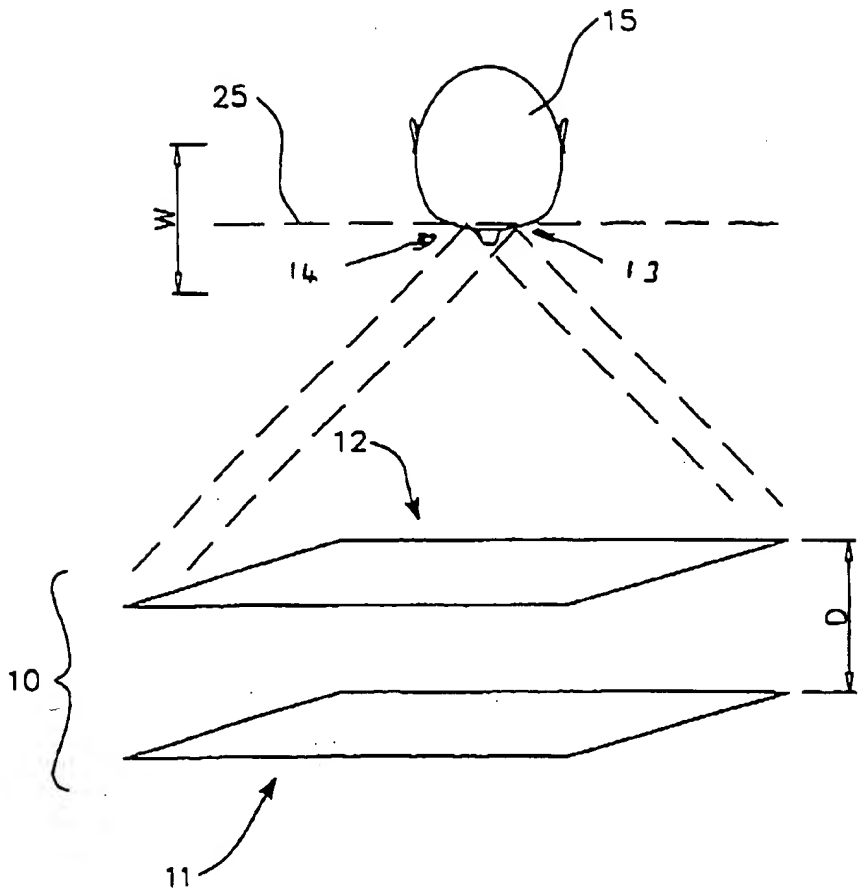

Fig. 1

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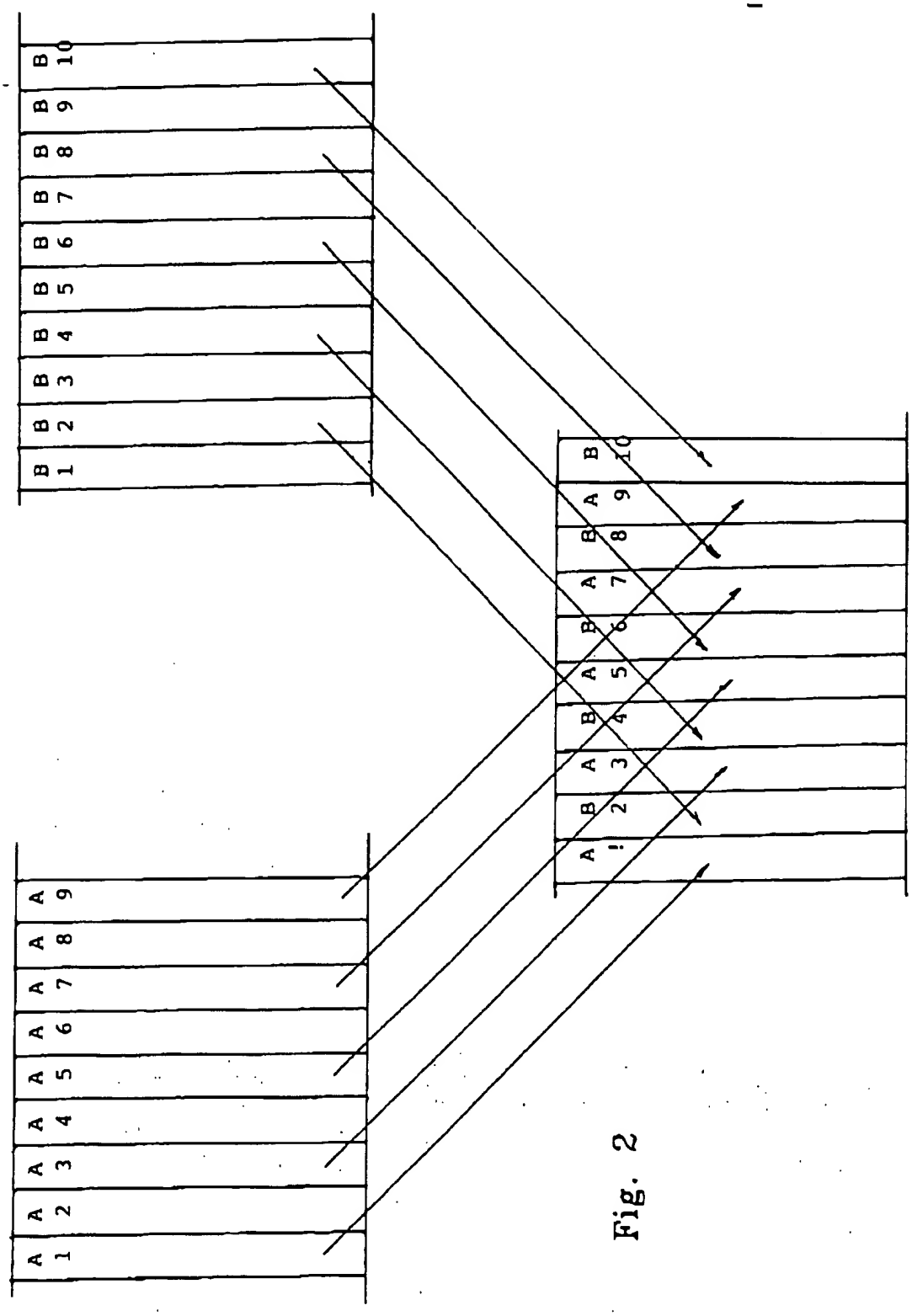

Fig. 2

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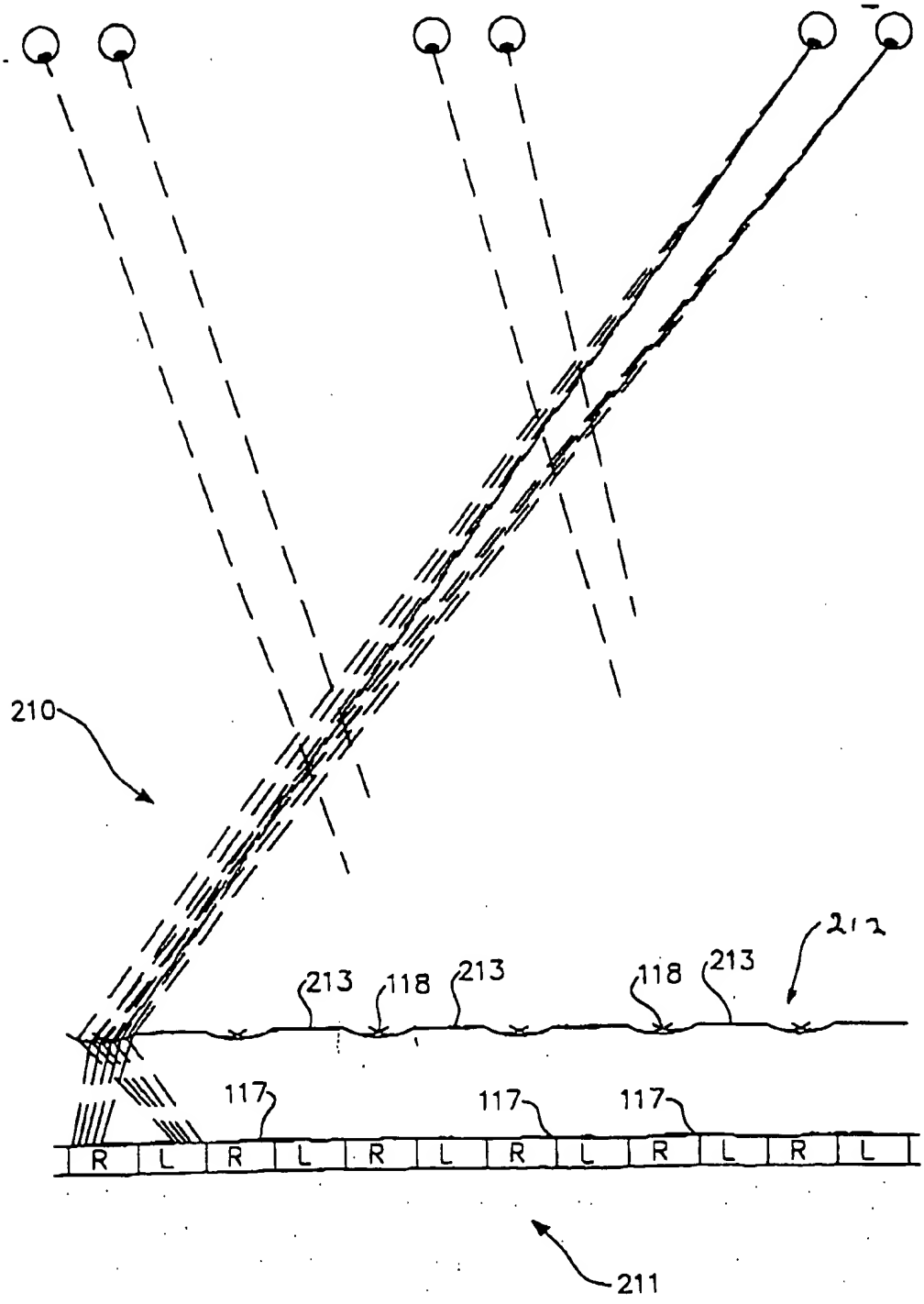

Fig. 7

PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION OF THE RECORDING OF A CHANGE

(PCT Rule 92bis.1 and Administrative Instructions, Section 422)

To:

CARTER SMITH & BEADLE
Level 10
189 Kent Street
Sydney NSW 2000
AUSTRALIE

Date of mailing (day/month/year)
21 April 1999 (21.04.99)

Applicant's or agent's file reference
#29109:PCD

IMPORTANT NOTIFICATION

International application No.
PCT/AU98/00635

International filing date (day/month/year)
12 August 1998 (12.08.98)

1. The following indications appeared on record concerning:

[ ] the applicant [ ] the inventor [X] the agent [ ] the common representative

Name and Address
CARTER SMITH & BEADLE
P.O. Box N301
Grosvenor Place
Sydney, NSW 1220
Australia

State of Nationality:
State of Residence:
Telephone No.: +612 9252 4333
Facsimile No.: +612 9252 4399
Teleprinter No.:

2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:

[ ] the person [ ] the name [X] the address [ ] the nationality [ ] the residence

Name and Address
CARTER SMITH & BEADLE
Level 10
189 Kent Street
Sydney NSW 2000
Australia

State of Nationality:
State of Residence:
Telephone No.: 612-9252-4333
Facsimile No.: 612-9252-4399
Teleprinter No.:

3. Further observations, if necessary:

4. A copy of this notification has been sent to:

[X] the receiving Office
[ ] the International Searching Authority
[X] the International Preliminary Examining Authority
[ ] the designated Offices concerned
[X] the elected Offices concerned
[ ] other:

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Facsimile No.: (41-22) 740.14.35

Authorized officer
Maria Kirchner

Telephone No.: (41-22) 338.83.38

Form PCT/IB/306 (March 1994)

002578746

PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION OF THE RECORDING OF A CHANGE

(PCT Rule 92bis.1 and Administrative Instructions, Section 422)

To:

CARTER SMITH & BEADLE
Level 10
189 Kent Street
Sydney NSW 2000
AUSTRALIE

Date of mailing (day/month/year)
26 April 1999 (26.04.99)

Applicant's or agent's file reference
#29109:PCD

IMPORTANT NOTIFICATION

International application No.
PCT/AU98/00635

International filing date (day/month/year)
12 August 1998 (12.08.98)

1. The following indications appeared on record concerning:

[X] the applicant [X] the inventor [ ] the agent [ ] the common representative

Name and Address
GARDENER, Anthony, John
5th floor
Suite 501
400 Hunter Street
Newcastle, NSW 2300
Australia

State of Nationality: AU
State of Residence: AU
Telephone No.:
Facsimile No.:
Teleprinter No.:

2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:

[ ] the person [X] the name [X] the address [ ] the nationality [ ] the residence

Name and Address
GARDNER, Anthony, John
25 Lanes Road
Wongawallan, QLD 4210
Australia

State of Nationality: AU
State of Residence: AU
Telephone No.:
Facsimile No.:
Teleprinter No.:

3. Further observations, if necessary:

4. A copy of this notification has been sent to:

[X] the receiving Office
[ ] the International Searching Authority
[X] the International Preliminary Examining Authority
[ ] the designated Offices concerned
[X] the elected Offices concerned
[ ] other:

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland
Facsimile No.: (41-22) 740.14.35

Authorized officer
F. Gateau
Telephone No.: (41-22) 338.83.38

PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

To:

United States Patent and Trademark Office
(Box PCT)
Crystal Plaza 2
Washington, DC 20231
ÉTATS-UNIS D'AMÉRIQUE

in its capacity as elected Office

Date of mailing (day/month/year) 26 March 1999 (26.03.99)	
International application No. PCT/AU98/00635	**Applicant's or agent's file reference** #29109:PCD
International filing date (day/month/year) 12 August 1998 (12.08.98)	**Priority date** (day/month/year) 12 August 1997 (12.08.97)
Applicant GARDENER, Anthony, John	

1. The designated Office is hereby notified of its election made:

[X] in the demand filed with the International Preliminary Examining Authority on:

11 March 1999 (11.03.99)

[ ] in a notice effecting later election filed with the International Bureau on:

2. The election [X] was

[ ] was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO **34, chemin des Colombettes** **1211 Geneva 20, Switzerland**	Authorized officer S. Mafla
Facsimile No.: (41-22) 740.14.35	Telephone No.: (41-22) 338.83.38

EC

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PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

REC'D 10 NOV 1999
WIPO PCT

Applicant's or agent's file reference #29109:GWN:JR	**FOR FURTHER ACTION**	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416).
International application No. **PCT/AU 98/00635**	International filing date *(day/month/year)* 12 August 1998	Priority Date *(day/month/year)* 12 August 1997

International Patent Classification (IPC) or national classification and IPC

Int. Cl.[6] H04N 13/00, 15/00; G02B 27/22; G03B 35/00

Applicant

GARDNER Anthony John

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 5 sheets, including this cover sheet.

[X] This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 13 sheet(s).

3. This report contains indications relating to the following items:

I	[X]	Basis of the report
II	[ ]	Priority
III	[ ]	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
IV	[ ]	Lack of unity of invention
V	[X]	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
VI	[ ]	Certain documents cited
VII	[X]	Certain defects in the international application
VIII	[X]	Certain observations on the international application

Date of submission of the demand	Date of completion of the report
11 March 1999	29 October 1999
Name and mailing address of the IPEA/AU AUSTRALIAN PATENT OFFICE PO BOX 200 WODEN ACT 2606 AUSTRALIA Facsimile No. (02) 6285 3929	Authorized Officer S. V. Samuel **SERINEL SAMUEL** Telephone No. (02) 6283 2382

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.
PCT/AU 98/00635

I. Basis of the report

1. With regard to the **elements** of the international application:*

- [ ] the international application as originally filed.
- [X] the description, pages , as originally filed,
  pages , filed with the demand,
  pages **1-8,** filed with the letter of **19 July 1999.**
- [X] the claims, pages , as originally filed,
  pages , as amended (together with any statement) under Article 19,
  pages , filed with the demand,
  pages **9,10,** filed with the letter of **19 July 1999.**
- [X] the drawings, pages , as originally filed,
  pages , filed with the demand,
  pages **1,2,7,** filed with the letter of **19 July 1999.**
- [ ] the sequence listing part of the description:
  pages , as originally filed
  pages , filed with the demand
  pages , filed with the letter of .

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.
These elements were available or furnished to this Authority in the following language which is:

- [ ] the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).
- [ ] the language of publication of the international application (under Rule 48.3(b)).
- [ ] the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, was on the basis of the sequence listing:

- [ ] contained in the international application in written form.
- [ ] filed together with the international application in computer readable form.
- [ ] furnished subsequently to this Authority in written form.
- [ ] furnished subsequently to this Authority in computer readable form.
- [ ] The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- [ ] The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

4. [ ] The amendments have resulted in the cancellation of:
   - [ ] the description, pages
   - [ ] the claims, Nos.
   - [ ] the drawings, sheets/fig.

5. [ ] This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).**

* *Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).*

** *Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report*

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	**4,5,7**	**YES**
	Claims	**1-3,6,8,9**	**NO**
Inventive step (IS)	Claims	**nil**	**YES**
	Claims	**1-9**	**NO**
Industrial applicability (IA)	Claims	**1-9**	**YES**
	Claims	**nil**	**NO**

2. Citations and explanations (Rule 70.7)

NOVELTY (N) claims 1-3,6,8,9

-AU 13076/92
-US 5049987

Each of these citations explicitly discloses all of the features of these claims. For example in AU 13076/92 see:

- Vertical image strip — page 4, line 34; page 6, line 14; page 9,line 4
- Right and left eye view — page 9, line 5; fig 2
- Opaque strips — page 5, line 35; figure 9
- Co-planer with lens — figure 9
- Circular cross section — page 2, line 20; page 3, line 21

INVENTIVE STEP

Claims 1-3,6,8,9: as above

Claims 4,5,7

The features added by these claims would either be obvious to a person skilled in the art or merely amount to adding common general knowledge.

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:

1. Claim 1 does not comply with Rule 6.3(b) because they are not properly cast out in the two-part form with those features which in combination are part of the prior art being placed into the preamble and the novel features being in a separate characterising portion.

2. The claims do not comply with Rule 6.2(b) because reference signs in parentheses relating the technical features mentioned to the drawings should be inserted in the claims to increase their intelligibility. This applies to both the preamble and the characterising portions.

VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

1. Claim 10 do not comply with Rule 6.2(a) because the claims should not rely on references to the description or the drawings.

PCT/AU98/00635

BOB

RECEIVED Sent to Melb
19 MAY 1999
CARTER SMITH & BEADLE

PATENT COOPERATION TREATY

PCT

From the INTERNATIONAL BUREAU

To:

CARTER SMITH & BEADLE
Level 10
189 Kent Street
Sydney NSW 2000
AUSTRALIE

NOTIFICATION OF THE RECORDING OF A CHANGE

(PCT Rule 92bis.1 and Administrative Instructions, Section 422)

Date of mailing (day/month/year)	
26 April 1999 (26.04.99)	
Applicant's or agent's file reference	**IMPORTANT NOTIFICATION**
#29109:PCD	
International application No.	**International filing date** (day/month/year)
PCT/AU98/00635	12 August 1998 (12.08.98)

1. The following indications appeared on record concerning:

[X] the applicant [X] the inventor [ ] the agent [ ] the common representative

Name and Address	State of Nationality	State of Residence
GARDENER, Anthony, John 5th floor Suite 501 400 Hunter Street Newcastle, NSW 2300 Australia	AU	AU
	Telephone No.	
	Facsimile No.	
	Teleprinter No.	

2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:

[ ] the person [X] the name [X] the address [ ] the nationality [ ] the residence

Name and Address	State of Nationality	State of Residence
GARDNER, Anthony, John 25 Lanes Road Wongawallan, QLD 4210 Australia	AU	AU
	Telephone No.	
	Facsimile No.	
	Teleprinter No.	

3. Further observations, if necessary:

4. A copy of this notification has been sent to:

[X] the receiving Office
[ ] the International Searching Authority
[X] the International Preliminary Examining Authority
[ ] the designated Offices concerned
[X] the elected Offices concerned
[ ] other:

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland	Authorized officer F. Gateau
Facsimile No.: (41-22) 740.14.35	Telephone No.: (41-22) 338.83.38

Form PCT/IB/306 (March 1994)

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